

THE ATLANTIC COASTAL PLAIN ELEMENT  
IN THE FLORA OF THE GREAT LAKES.

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*(Continued from page 70.)*

TOPOGRAPHY OF THE GREAT LAKES SHORES AT THE CLOSE  
OF THE GLACIATION.

But were there really any warm shallow lagoons and bays? There seem to have been, for a countless number of shallow bays and old sand spits enclosing lagoons have been traced by many geologists and shown to have existed extensively during the Algonquin stage.

It is significant that the stations for coastal plain isolations along the Great Lakes occur precisely where some of the spits and lagoons still exist, as at Presque Isle and Cedar Point on Lake Erie, and around Pine and Dune Park at the head of Lake Michigan where a long era of spit-forming and lagoon-forming is just drawing to a close.

TOPOGRAPHY AND FLORA OF THE POST-TOLLESTON BEACHES.

The Post-Tolleston is that period of transition between the glacial Lake Chicago and modern Lake Michigan and is synchronous with the Algonquin stage over the Great Lakes as a whole, particularly with the latter phases of the Algonquin. During this period the strand line of Lake Chicago receded in places about six miles and this it did slowly, building up barrier beaches and forming lagoons behind them, and then receding a little more, to build up another bar and lagoon. The lagoons are, many of them, of recent date and their beaches are still intact.

The result is a topography which is scenically monotonous, being a series of ridges and hollows which are about one hundred meters wide, the hollows never more than three or four meters above the level of the present lake, and the ridges scarce two meters above the hollows. There are by actual count 32 such ridges in the four miles between the village of Gibson and the lake shore<sup>1</sup>.

The hollows nearest to the present shore are still what might properly be called lagoons; they are occupied by swamp and pond types among which are coastal plain plants, while on the sandy ridges near the shore are many strand plants of the Atlantic coast. But as we

<sup>1</sup> Leverett and Taylor, loc. cit. 357.

progress inward we do not find the hollows filled with water; they are only moist swales, and the ridges are covered by that peculiar vegetation which E. J. Hill has called the "pine barrens of Indiana" and Dr. H. C. Cowles has classified as evergreen dunes or dune heath. Both the swales and the pine ridges show a less-markedly coastal plain character. Further inland still the hollows are nearly as dry as the ridges and are distinguished by very few coastal plain plants (chiefly arenicolous if any) and more and more frequently by prairie types or by the oak barrens which are, for the most part, Alleghenian and Carolinian.

This spot and a few similar ones along the Great Lakes show all that are left of conditions which approximate those which must have been prevalent on the margins of Lake Algonquin. Judging from the large number of old spits and beach ridges which have been traced out for the glacial lakes giving rise to Lake Erie and Lake Michigan, it is reasonable to imagine their shores to have been an intricate series of lagoons, ridges, strands and low dunes, harboring the newly-migrated coastal plain and strand types. This is the more evident when we see that considerable numbers of coastal plain species occur to-day in such places, and rarely occur in others.

#### FLORA OF THE OUTLETS OF THE GLACIAL LAKES.

It might reasonably be expected that where there were important inlets and outlets of the glacial lakes system, there would be isolations of coastal plain plants. And this is precisely what we find. The narrow St. Clair River, which at the present day forms the connective between Lake Huron and Lake Erie, has at all stages been the only connection. This then, is the gate through which all coastal plain migrations necessarily took place. And it is interesting to record that the coastal plain flora of Port Huron and its vicinity, at the outflow of Lake Huron, is large. So also are the floras of Saginaw Bay and Grand Rapids, which are, respectively at the east and west extremities of the Grand River Valley, the one-time connective across Michigan, seen in Figure 3.

The flora of the Hudson-Mohawk Valley and of the Lake Ontario basin of New York State, particularly around Oneida Lake, contains almost as many coastal plain species as the head of Lake Michigan. The area shows, of course, a good many types which come up from the Atlantic seaboard and do not extend further inland, but they also, with the presence of a large number of the coastal plain types which

do follow the Great Lakes, serve to point the path by which these plants must have travelled. Consequently I have thought it not too extraneous to place in the list at the end of this paper, the coastal plain types in the Mohawk-Hudson Valley and Ontario Basin, whether or not they reach the Great Lakes. It gives me pleasure to acknowledge the kind assistance of Prof. Wiegand in preparing this part of the work.

The connectives through central Ontario and the Ottawa River Valley, which are so conspicuous on the map of the Algonquin stage, are not well known to me in their floristic aspects. But the Ottawa Valley has at least a few coastal plain species to show, such as *Juncus pelocarpus*, *Utricularia resupinata*<sup>1</sup>, *Elatine americana*<sup>2</sup>, *Carex exilis*<sup>3</sup>, *Sporobolus uniflorus*<sup>4</sup>, and *Isoetes riparia*.

And lastly, the sand dunes of the Illinois River, of which we are fortunate in possessing a catalogue of the flora<sup>5</sup>, have about eight true coastal plain species. A glance at any of the maps of the glacial lakes will show that the Illinois River functioned as the outlet for Lake Chicago during all the period of which we are speaking. This outlet was, judging from geological evidences, a broad and deep one, lined on its sides by many local sand deposits. It is hardly necessary to state that the presence of some twelve coastal plain species there is in part due to the migration along the shores of the glacial lakes and their outlets.

In the case of the Illinois River, however, as in the case of its tributary the Kankakee, it must be remembered that they have probably been open to more than one coastal plain influence—that is, since they have at different times been connected with the St. Lawrence Basin and with that of the Mississippi, they perhaps owe the origin of their coastal plain elements to both valley systems. Thus such plants as *Rynchospora corniculata* and its variety *interior*, have probably reached Illinois and Indiana by way of the Mississippi Valley and not by way of the Great Lakes. This may be inferred from the fact that these plants are found today well up in the Mississippi Basin and are not found across the Great Lakes shores. To the same path of migration *Mikania scandens* probably owes its presence on the Kanka-

<sup>1</sup> Macoun, Proc. & Trans. Roy. Soc. Can. xii. 30 (1894).

<sup>2</sup> Fernald, RHODORA, xix. fig. 12 (1917).

<sup>3</sup> Fernald, Proc. Am. Acad. xxxvii. 482 (1902).

<sup>4</sup> Macoun, Ottawa Nat. xxiii. 192 (1910).

<sup>5</sup> Gleason, loc. cit.

kee River in Indiana, only some thirty miles south of the old Lake Chicago Basin. The Kankakee itself flows through the site of an old glacial lake bed. But this glacial lake drained into the Mississippi Basin and not into Lake Chicago, and as *Mikania scandens* is not found on the Great Lakes, although extending by way of the Mohawk and Hudson to the Ontario Basin, it is best treated as a plant of the southern coastal plain reaching a northern limit in Indiana, and not one of the migrants of the Great Lakes. Another coastal plain and piedmont plant reaching a northern limit on the Kankakee is *Betula nigra*, and there are others of the same sort.

#### THE NEGATIVE EVIDENCE.

There is a certain amount of negative evidence in favor of the glacial lakes as a pathway of migration for coastal plain plants. In the first place, we know only a single coastal plain species<sup>1</sup> on the Great Lakes which is not also found fairly far north on the true coastal plain—far enough north for it to have migrated by way of the New York State connectives with the glacial lakes. In other words, coastal plain plants ranging from the Gulf around Florida to about the latitude of Delaware, *but not northward*, are almost wholly absent from the Great Lakes, though they may often reach far up the Mississippi Basin and be found in southern Illinois, Indiana or Ohio. Such a range have *Styrax americana*, *Taxodium distichum*, *Jussiaea decurrens*, *Spigelia marilandica*, and many others. It is evident, therefore, that few, if any, of the coastal plain plants of our area have come by way of the Mississippi Basin.

And in the second place, there is the flora of the sand hills of Nebraska, with which there has never been any glacial lake connective which could be satisfactorily demonstrated. And we have already seen that not a single true coastal plain species exists there.

#### THE ZOOLOGICAL EVIDENCE.

There is a little zoological evidence which is corroborative of that of the plants. Animals, being free-moving organisms, are in general less restricted in their ranges than plants. But there are a few animals ordinarily confined to the coastal plain which are isolated in the area

<sup>1</sup> *Eleocharis caribaea* (*capitata*) var. *dispar*, which is an endemic of the Lake Michigan region, derived from true *E. caribaea*, a plant not known on the coastal plain north of Maryland, though further investigations may give it a station far enough north to displace it as an exception to the rule.

around the head of Lake Michigan. The lake itself contains a *Mysis*, a marine crustacean<sup>1</sup>. And I have it upon the authority of Mr. T. H. Hubbell of the University of Michigan, that the dune grasshopper, *Trimerotropis maritima interior* is an endemic offshoot of the coastal plain true species. A similar endemic offshoot is another member of the Orthoptera, *Neoconocephalus robustus crepitans*, and still another grasshopper, *Psinidia fenestralis* is found not only along the Atlantic, but on the shores of the Great Lakes and also west of the Mississippi where the soil is sufficiently sandy. And Mr. R. F. Hussey, who has collected animals in Berrien County, Michigan, informs me that one snake which is, in a general way, of the coastal plain, shows the same discontinuous range; it is the pilot snake, *Heterodon contortrix*.

#### A TABULAR VIEW OF INLAND EXTENSIONS OF THE COASTAL PLAIN FLORA.

In conclusion, and in order to give a summary of the inland extensions of the coastal plain flora, I append a tabular view of the stations for each coastal plain species which is found along the Great Lakes and connected waters, so far as I am able to discover. Beside my work in herbaria, I have relied upon a large number of published floras<sup>2</sup>. I have tried to use discrimination with this second- and third-hand information, omitting species of great improbability and using question marks in the case of plants which have, since being reported, been demonstrated by systematists to embrace more than one distinct species, so that it has become impossible to tell just what older writers had in hand when reporting such a species. Thus *Lilium superbum* is really a coastal plain species, but so many things have in the past gone under that name, that I have thought it best to leave it out altogether, despite persistent reports of its occurrence inland. So

<sup>1</sup> Chicago Folio of the U. S. Geol. Surv. 10.

<sup>2</sup> Beckwith & Macaulay, Plants of Monroe County, New York, and Adjacent Territory, Proc. Rochest. Acad. Sci. iii. 1-150 (1896).

Blatchley, Geology of Porter and Lake Counties, 22nd Ann. Rep. Ind. Geol. & Nat. Res. 92-102 (1897).

Cole, Grand Rapids Flora, 1-160 (1901).

Coulter, S., Catalogue of the Flowering Plants and of the Ferns and their Allies Indigenous to Indiana, 24th Ann. Rep. Dept. Geol. Nat. Res. Ind. 553-1072 (1899).

Day, Plants of Buffalo and its Vicinity, Bull. Buffalo Soc. Nat. Sci. iv, 9-156 (1882).

Deam, Plants New to Indiana, Proc. Ind. Acad. Sci. 144-150 (1918).

Dodge, C. K. Annotated List of Flowering Plants and Ferns of Point Pelée, Ontario and Neighboring Districts, Can. Geol. Surv. v. biol. ser. 2, 8-107 (1914).

—Catalogue of Plants, in A Biological Survey of the Sand Dune Region on the.

also I have had to leave queries for the two coastal plain varieties of *Andropogon scoparius*. They are of such recent distinction that that there has not been time for full reports of their ranges to appear. Species in italics are endemic derivatives of coastal plain types.

In the following list, it may be wondered that a column is not given to Lake Superior. That it is not, is partly due to the fact that I am not familiar with Lake Superior plants and that no adequate accounts of the flora exist. But it is also due to the fact that in all probability no important stations for coastal plain extensions occur on Lake Superior. In looking up the ranges of the approximate hundred of coastal plain extensions in the inland, I have been impressed by the fact that the meagerest sprinkling of them occur on Lake Superior; herbarium specimens and reliable reports are in great part lacking for these species in that area.

Probably there has occurred no great westward migration of coastal plain plants to Lake Superior. This is the more proven when we recall that Lake Superior was the last of the Great Lakes to be uncovered by the glacier; it was still under the ice when the other lakes were clear of it and probably thriving with marginal vegetation. It is, moreover,

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South Shore of Saginaw Bay, Michigan (edited by Ruthven), Mich. Geol. & Biol. Surv. iv, biol. ser. 2, 72-120 (1911).

—Flowering Plants, Ferns and Fern Allies Growing without Cultivation in Lambton County, Ontario, 16th. Ann. Rep. Mich. Acad. Sci. 137-200 (1914). This range includes Port Huron, Michigan.

Dudley, The Cayuga Flora, Bull. Cornell Univ. ii. 1-132 (1886).

Gates, The Vegetation of the Beach Area in Northwestern Illinois and Southeastern Wisconsin, Bull. Ill. State Lab. Nat. Hist. ix<sup>5</sup>. 353-369 (1912).

Gleason, Vegetation of the Sand Deposits of Illinois, Bull. Ill. State Lab. Nat. Hist. ix<sup>3</sup>, 146-170 (1910).

Goodrich, Flora of Onondaga County, 7-193 (1912) (a compilation accepted with some reservations).

Higley & Raddin, Flora of Cook County, Illinois, and a part of Lake County, Indiana, Bull. Chi. Acad. Sci. ii<sup>1</sup>, 1-156 (1891) (a compilation accepted with some reservations but including the results of the splendid collections of E. J. Hill from northern Indiana).

Jennings, Botanical Survey of Presque Isle, Erie County, Pennsylvania, Ann. Carnegie Mus. v. 405-421 (1909).

Kellerman & Werner, Ohio Plants, Geol. Ohio, viii, 56-403 (1893) (a compilation accepted with some reservations).

Mosley, Sandusky Flora, Ohio State Acad. Sci. spec. pap. i. 35-162 (1899).

Paine, Catalogue of Plants found in Oneida County and Vicinity, Rep. Regents. Univ. N. Y. State, 1-140 (1865).

Pieters, Plants of Western Lake Erie, U. S. Fish. Comm. Bull. 77-79 (1901)

Rydberg, Flora of the Sand Hills of Nebraska, Contrib. Nat. Herb. iii. 133-203, (1895).

Schaffner, Catalogue of Ohio Plants, Ohio Biol. ii<sup>1</sup>. 131-237. (1914).

a lake, not of warm coastwise lagoons and sandy shores like the others, but a cold and bleak one surrounded by mountainous country—the habitat of northern types of plants.

	Hudson-Mohawk Valley and Ontario Basin (Finger Lakes).	Shores of Lake Ontario.	Region of Lake Erie.	Detroit & St. Clair Rivers, Lake St. Clair & Port Huron.	Saginaw Bay (Lake Huron)	Grand Rapids (Grand River)	Region of Lake Michigan.	Dunes of Illinois River.
<i>Woodwardia virginica</i> .....	×		×	×	×	×	×	
<i>Isoetes Engelmanni</i> .....	×							
<i>Potamogeton pulcher</i> .....							×	
<i>Potamogeton bupleuroides</i> .....	×						×	
<i>Potamogeton hybridus</i> .....			×		×		×	
<i>Najus gracillima</i> .....	×		?				×	
<i>Andropogon scoparius</i> , var. <i>villosissimus</i>	?	?	?	?	?	?	×	?
<i>Andropogon scoparius</i> , var. <i>polycladus</i> ( <i>littoralis</i> )	?	?	?	?	?	?	×	?
<i>Panicum debile</i> ( <i>verrucosum</i> ).....							×	
<i>Panicum lucidum</i> .....							×	
<i>Panicum spretum</i> .....							×	
<i>Panicum meridionale</i> .....				×	×		×	
<i>Panicum albemarlense</i> .....							×	
<i>Panicum oligosanthos</i> .....							×	
<i>Echinochloa Walteri</i> .....	×		×	×			×	
<i>Ammophila breviligulata</i> ("arenaria")...		×	×	×	×		×	
<i>Aristida tuberculosa</i> .....							×	×
<i>Eleocharis quadrangulata</i> .....	×		×	×		×	×	
<i>Eleocharis interstincta</i> .....							×	
<i>Eleocharis melanocarpa</i> .....							×	
<i>Eleocharis caribaea</i> ( <i>capitata</i> ), var. <i>dispar</i>							×	
<i>Psilocarya scirpoides</i> .....						×	×	
<i>Psilocarya nitens</i> .....						×	×	
<i>Fimbristylis autumnalis</i> .....	×		×			×	×	×
<i>Scirpus Eriophorum</i> .....			×				×	
<i>Scirpus Smithii</i> .....	×		×			×	×	
<i>Fuirena squarrosa</i> <sup>1</sup> .....			?				×	
<i>Hemicarpha micrantha</i> .....	×		×			×	×	×

<sup>1</sup> The report from "northern Ohio" (Kellerman & Werner) is probably incorrect, as is also that from central New York State given by Sartwell and quoted by Coville, Revision of U. S. Species of the Genus *Fuirena*, Bull. Torr. Bot. Club, xvii. 8.

	Hudson-Mohawk Valley and Ontario Basin (Finger Lakes)	Shores of Lake Ontario.	Region of Lake Erie.	Detroit & St. Clair Rivers, Lake St. Clair & Port Huron.	Saginaw Bay (Lake Huron).	Grand Rapids (Grand River)	Region of Lake Michigan.	Dunes of Illinois River.
<i>Rynchospora fusca</i> .....	×			×	×			
<i>Rynchospora cymosa</i> .....			×				×	
<i>Rynchospora macrostachya</i> .....						×	×	
<i>Scleria reticularis</i> .....							×	
<i>Scleria reticularis</i> var. <i>pubescens</i> ...							×	
<i>Carex annectans</i> (true).....	×							
<i>Carex alata</i> .....	×					×	×	
<i>Carex exilis</i> .....	×							
<i>Peltandra virginica</i> .....	×		×			×	×	
<i>Orontium aquaticum</i> .....	×							
<i>Xyris caroliniana</i> <sup>1</sup> .....	×		×		×		×	
<i>Xyris torta</i> ( <i>flexuosa</i> ).....			×				×	×
<i>Juncus Greenii</i> .....				×			×	
<i>Juncus balticus</i> var. <i>littoralis</i> .....	×	×	×	×	×	×	×	
<i>Juncus articulatus</i> .....	×		×	×		×	×	
<i>Juncus aristulatus</i> .....			×					
<i>Juncus dichotomus</i> , var. <i>platyphyllus</i>	×							
<i>Juncus scirpoides</i> .....	?		×				×	
<i>Juncus pelocarpus</i> .....	×	×		×		×	×	
<i>Sisyrinchium Farwellii</i> .....				×				
<i>Sisyrinchium atlanticum</i> .....							×	
<i>Sisyrinchium apiculatum</i> .....							×	
<i>Listera australis</i> .....	×							
<i>Myrica carolinensis</i> .....	×	×	×					
<i>Alnus rugosa</i> .....	×							
<i>Quercus prinoides</i> <sup>2</sup> .....			×	×		×	?	
<i>Polygonum pennsylvanicum</i> (true)...	×						×	
<i>Polygonella articulata</i> .....	×		×	×	×		×	×
<i>Nelumbo lutea</i> .....		×	×				×	
<i>Cakile edentula</i> .....	?	?	?	?	?		×	
<i>Cakile edentula</i> var. <i>lacustris</i> .....		?	×	×			×	
<i>Drosera longifolia</i> .....	×		×			×	×	
<i>Spirea tomentosa</i> var. <i>rosea</i> <sup>3</sup> .....							×	
<i>Lupinus perennis</i> .....	×		×	×	×		×	×
<i>Lathyrus maritimus</i> var. <i>glaber</i> .....	×	×	×	×	×		×	

<sup>1</sup> The specimen in the Gray Herbarium which is recorded here from Lake Huron comes, more strictly, from Georgian Bay.

<sup>2</sup> The reports from Indiana and New York State are of doubtful authenticity.

<sup>3</sup> Fernald, RHODORA xiv. 190, an endemic derivative occurring also in the mountains of North Carolina.



	Hudson-Mohawk Valley and Ontario Basin (Finger Lakes)	Shores of Lake Ontario.	Region of Lake Erie.	Detroit & St. Clair Rivers, Lake St. Clair & Port Huron.	Saginaw Bay (Lake Huron)	Grand Rapids (Grand River)	Region of Lake Michigan.	Dunes of Illinois River.
<i>Linum striatum</i> .....			×			×	×	
<i>Polygala cruciata</i> .....			×			×	×	
<i>Euphorbia polygonifolia</i> .....	×	×	×	×	×		×	
<i>Hypericum gymnanthum</i> .....			×				×	
<i>Elatine minima</i> <sup>1</sup> .....	×		×				×	
<i>Lechea minor</i> .....			×				×	
<i>Lechea maritima</i> .....			×				×	
<i>Rotala ramosior</i> .....			×				×	
<i>Ludvigia sphaerocarpa</i> .....			×				×	
<i>Hydrocotyle umbellata</i> <sup>2</sup> .....	×		?				×	
<i>Hottonia inflata</i> .....			×				×	
<i>Lyonia ligustrina</i> .....	×		×				×	
<i>Nymphoides lacunosum</i> .....	×		×				×	
<i>Convolvulus sepium</i> , var. <i>pubescens</i> .			×				×	
<i>Onosmodium virginianum</i> .....	×		?				×	
<i>Stachys hyssopifolia</i> .....			×			×	×	
<i>Agalinus</i> ( <i>Gerardia</i> ) <i>purpurea</i> .....			×			×	×	×
<i>Linaria canadensis</i> .....			×		×	×	×	
<i>Utricularia clandestina</i> .....			?			×	×	
<i>Utricularia gibba</i> .....	×		×			×	×	
<i>Utricularia resupinata</i> .....			×	×		×	×	
<i>Utricularia purpurea</i> .....			×			×	×	
<i>Mikania scandens</i> .....	×						×	
<i>Solidago tenuifolia</i> .....						×	×	
<i>Solidago Mosleyi</i> .....			×				×	
<i>Bidens discoides</i> .....	×			×			×	
<i>Cirsium pumilum</i> <sup>3</sup> .....	×		?	×			×	

<sup>1</sup> Does not go far west in New York State. The specimen is in the Gray Herbarium from Chisago, Minn.

<sup>2</sup> The old report from the Ontario basin was a false one, but the plant recently introduced at Ithaca, N. Y.

<sup>3</sup> *C. Hillii* of the west is too difficult to separate from *C. pumilum* and occupies too general a range there to justify calling it an endemic derivative.

The report of *C. pumilum* from Buffalo is doubtfully correct.